HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Dungeness River Chinook
Species or Hatchery Stock:	Dungeness River Chinook (*Oncorynchus tshawytscha*)
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Dungeness River (Strait of Juan de Fuca) Puget Sound
Date Submitted:	, 2004
Date Last Updated:	June 07, 2004

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Dungeness River Chinook program

1.2) Species and population (or stock) under propagation, and ESA status.

Dungeness River Chinook (*Oncorhynchus tshawytscha*) - listed as "threatened"

1.3) Responsible organization and individuals

Name (and title):	Ron Warren, Region 6 Fish Program Manager Don Rapelje, Dungeness Complex Manager	
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

In addition to WDFW, the Point-No-Point Treaty Tribe, U.S. Fish and Wildlife Service and the U.S. Forest Service are also involved in this restoration program.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

This program is funded through the State General Fund.

1.5) Location(s) of hatchery and associated facilities.

Broodstock Collection (2004), Incubation, Rearing and Release:

Dungeness Hatchery:	Dungeness River (18.0018) RM 10.5

Rearing and Release;

Hurd Creek Hatchery:	Hurd Creek (18.0028) RM .2, trib to Dungeness River (18.0028) at RM 3.

Rearing and Release:

Gray Wolf Acclimation Pond:	Gray Wolf River (18.0048) at RM 1, trib to Dungeness River at RM 16.

1.6) Type of program.

Integrated recovery

1.7) Purpose (Goal) of program.

Restoration

The goal of this program is the protection and restoration of the indigenous (spring) chinook salmon to a self sustaining level (McElhany et al. 2000), without risk to extinction, in the Dungeness River watershed.

1.8) Justification for the program.

The Dungeness River Chinook returns have declined to critically low levels, leaving them at risk of extinction. The Dungeness Chinook Salmon Rebuilding Project was initiated in 1992 with the goal of providing a healthy, self-sustaining population that maintained the genetic characteristics of the existing chinook salmon stock. The main component of the project was a captive broodstock program. The project was designed to rebuild the extremely low runsize of chinook (<200/year) by releasing progeny from the captive brood into the Dungeness and Gray Wolf rivers. Although the co-managers' have recognized that some progress has been made towards chinook recovery in the Dungeness system through the captive broodstock program, it is very apparent that habitat restoration has not kept pace with the captive brood and harvest protection components of the rebuilding project. Habitat conditions continue to place all salmonid stocks at great risk, therefore, the decision has been made to continue to supplement the Dungeness chinook population by collecting returning broodstock and producing up to 200,000 juveniles annually for release into the Dungeness River system.

1.9) List of program "Performance Standards".

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

Performance Standards and Indicators for Puget Sound **Integrated Recovery** Chinook programs.

Performance Standard	Performance Indicator	Monitoring and Evaluation Plan

Produce adult fish for spawning escapement Produce Captive Brood Adults and collect adults for supplementation	Survival and return rates Survival of Captive Brood to Spawning and survival of collected adults until spawned or returned to river	Monitor catch and survivals using CWTs, otolith marks, blank wire tags and escapement data. Hatchery records
Meet hatchery production goals	Number of juvenile fish released - **see section 1.11.2**	Estimating number of fish planted (weighing / counting fish), monitoring proximity to hatchery production goals, number released recorded on Hatchery Division's "plants reports", data available on WDFW database.
Manage for maximum escapement	Hatchery and wild return rates	Monitoring hatchery / wild return rates through trapping (at the hatchery or at weir), redd and snorkel surveys on the spawning grounds plus catch records
Minimize interactions with listed fish through proper broodstock management	Total number of captive broodstock spawned and adult broodstock collected- **see section 1.11.1 & 6.2.3**	Measure number of fish actually spawned to meet eggtake goal Hatchery records Collect eggs/fry throughout run, dates and times recorded on Hatchery Division's "adult reports, dates available on WDFW database. Spawner survey data, CWT data, otolith marks, blank wire tag/no adipose fin clip data
	Sex ratios	
	Timing of captive brood and collected adult spawning- **August-September**	
	Random captive brood collection from redds and adults from in-river	
	Hatchery stray rate	
	Number wild fish used in broodstock - **unknown (see section 1.16)**	

	Return timing of hatchery / wild adults - **see section 2.2.1**	
	Adherence to spawning guidelines - **1:1 ratio**	
Minimize interactions with listed fish through proper rearing and release strategies	Juveniles released as smolts	Future Brood Document (FBD)
	Outmigration timing of listed fish / hatchery fish - **see section 2.2.1**	Hatchery records CWT data
	Size and time of release **see section 1.11.2**	Otolith marks
Maintain stock integrity and genetic diversity	Effective population size	Spawning guidelines
	Monitor divergence of hatchery fish morphology and behavior characteristics	Spawner surveys
	HOR spawners	
Maximize in-hatchery survival of broodstock and their progeny; and Limit the impact of pathogens associated with hatchery stocks, on listed fish	Fish pathologists will monitor the health of hatchery stocks on a monthly basis and recommend preventative actions / strategies to maintain fish health	Co-Manager Disease Policy
	Fish pathologists will diagnose fish health problems and minimize their impact	Fish Health database
	Vaccines will be administered when appropriate to protect fish health	

	A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings	
	Fish health staff will present workshops on fish health issues to provide continuing education to hatchery staff.	
Ensure hatchery operations comply with state and federal water quality standards through proper environmental monitoring	NPDES compliance	Monthly NPDES reports

** Plant all available Dungeness River chinook juveniles, produced from captive brood adults and collected adults, by several different rearing and release categories as follows:

Plant 100,000 zero-age smolts from Gray Wolf Acclimation pond;
Plant 600,000 fry into several locations along the Gray Wolf
Plant 400,000 fed fry into several locations in the upper Dungeness;
Plant 100,000 yearlings into Hurd Creek.
Plant 100,000 yearlings into the Dungeness River from the Dungeness Hatchery.
Note: This program's remaining egg takes will vary depending on the number of females available for spawning from the captive brood (see 1.11.1 below).

Progeny of Adults Collected in 2004:
Plant up to 100,000 zero-age (fingerlings) smolts in Gray Wolf and Dungeness rivers
Plant up to 100,000 yearlings into the Dungeness River

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

Broodstock collection, from wild chinook salmon redd pumping, for this rebuilding program, ended in 1997 with the collection of 1997 brood eggs (6 brood years, 1992 through 1997). Since that time, eggs have been derived from captive reared adults that resulted from the 1992 thru 1997 collection of eggs. In June, 2002 still had 412 Dungeness captive brood at Hurd Creek. In July of that year 313 were shipped to Dungeness for spawning. The following July (2003), 66 mature adults were shipped from Hurd Creek to Dungeness. There are currently 13 (Oct, 2003) captive brood remaining at Hurd Creek.

In late summer of 2004, up to 112 adult chinook will be collected from the Dungeness River and spawned as a continued supplementation effort.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

Note: See 9.1.2 for further information.

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Yearling		

As the Captive Brood egg source diminishes in the future (ending with the 2004 BY), the following release strategies will be dropped in the approximate following order: option A, option C, option B and option D. Options E, F and then G will continue described in Table 2 below.

Table 1.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry	A. 200,000 (3) B. 400,000 (3) C. 200,000(2) D. 200,000 (3)	450* 250 250 200	May June/July June/July June/July	Grey Wolf River Gray Wolf River Dungeness River Gray Wolf River
Fingerling	E. 100,000 (4)	40	May/June(6)	Gray Wolf River
Yearling	F. 100,000(1) G. 100,000(5)	8 to 10 8 to 10	April(6) April(6)	Dungeness River Hurd Creek

Fish releases from annual broodstock collection beginning in 2004 BY**(Table 2)

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Fingerling (Zero-age)	0-50,000 0-50,000	40	May/June	Dungeness R. Gray Wolf R.
Yearling	50,000-100,000 50,000-100,000	8-10 8-10	April April	Dungeness R. Hurd Creek

* - Numbers in each release strategy may vary based on an on-going Dungeness supplementation evaluation. This was the initial production/release strategy of the program (Table 1).

(1) Dungeness River (18.0018) at Dungeness Hatchery RM 10.5, Dungeness River, Puget Sound.

(2) Dungeness River (18.0018) at various locations in the upper watershed, Dungeness River, Puget Sound

(3) Gray Wolf River (18.0048) at various locations in the upper watershed, Dungeness River, Puget Sound

(4) Gray Wolf River (18.0048) from the Gray Wolf Acclimation Pond RM 1.0, Dungeness River, Puget Sound

(5) Hurd Creek Hatchery (18.0028) in the lower Dungeness River.

(6) Release dates will be in June in even years and in May in odd years to minimize potential predation impacts on even year broods of Dungeness River Pink salmon (old program).

** - See section 10.1 for fpp conversion to millimeters (mm) fork length. Table 2 is the new production/release strategy for the Dungeness spring chinook supplementation program.

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

The 1996 brood was the first year with significant releases (1997) of 421,000 fry and 1,353,000 fingerlings. Since chinook salmon in Puget Sound typically have a life span of 3-5 years, this brood would be expected to contribute primarily in the years 1999 through 2001. Preliminary results for 1996 and 1997 releases indicate that smolt-to-adult survival rates have ranged from 0 .015% to fingerlings released from acclimation ponds (Grey Wolf River) to ~1.0% for a yearling release from Hurd Creek Hatchery (a satellite station for the Dungeness Hatchery). Despite these relatively low survival rates, preliminary results suggest that adult returns from the program comprised a significant percentage of the total number of spawners in natural spawning areas in 2000 (>50% of the 218 spawners) and 2001 (> 90% of the 453 spawners).

Wild spring chinook escapement goal is 925 and is based on the fair to poor habitat status outside the Olympic National Park and historic run size information.

1.13) Date program started (years in operation), or is expected to start.

The captive broodstock program was started in 1992 with the collection of wild origin eggs and fry from natural redds. Collection of wild origin eggs or fry continued through

1997 (6 brood years). Fish deriving from the collection process were reared as captive brood until they mature and were spawned.

A new supplementation program will begin with the collection of adult chinook from the river in 2004.

1.14) Expected duration of program.

Captive Broodstock Program:

Twelve years (2004, pending discussions of Technical Advisory Committee) as outlined in: *Dungeness River Chinook Salmon Rebuilding Project; Progress Report 1992-93; WDFW, Jamestown S'Klallam Tribe, USFWS Project Report Series #3, 1995*)

Adult Collection and Supplementation:

This program will continue until the the desired annual escapement goal for the system is 925 spawners is reached in three of four consecutive years and habitat improvements are accomplished that assure long-term productivity of this stock.

1.15) Watersheds targeted by program.

These chinook are destined for release solely into the Dungeness River watershed (WRIA 18).

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

The Dungeness River Chinook Technical Advisory Committee ("TAC") considered the duration of captive brood collection, i. e., how many years to collect wild brood. It was determined that wild brood collection would be undertaken for only 6 brood years (1992 through 1997) and would *end* after the 1997 wild stock return year. The 1998 brood year would not be collected as it would contain an unknown number of 2 and 3 year old returns which were derived from the 1992 and 1993 brood captive brood fish (which matured and produced the 1995 and 1996 brood hatchery progeny.) Likewise, future returning brood would not be collected as it would contain unknown levels of hatchery origin fish. The TAC determined that there is too much risk of losing genetic diversity and genotype "swamping" by re-incorporating hatchery derived captive brood into the program. (A. Appleby, WDF&W, pers. comm.). Since that time, an alternate management decision has been made by WDFW and the Jamestown S'Klallam Tribe (Bill Freymond, WDFW, pers. comm.). The decision is to continue supplementing this stock with progeny from adults collected from the river. Habitat improvements have not kept pace with the fish supplementation in the system and serious problems remain, especially in the lower river where 70% of the adults spawn. Unstable spawning and rearing habitat

continues to be the result of channelization and diking for flood control, urban development, water withdrawals for irrigation and domestic use and pollution from agricultural and urban run-off (Herring, 1999). WDFW and the Jamestown S'Klallam Tribe agree that the risk of losing this stock due to unstable habitat is greater than the risk of losing genetic diversity by potentially incorporating some hatchery derived broodstock into the supplementation program.

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

2.1) List all ESA permits or authorizations in hand for the hatchery program.

See section 3.1 and 3.2

2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.

2.2.1) Description of ESA-listed salmonid population(s) affected by the program.

- Identify the ESA-listed population(s) that will be directly affected by the program.

Puget Sound chinook, specifically the Dungeness River population.

Adult Age Class Structure - Ages range from 2 to 6 year olds, predominately 4 year olds.

Sex Ratio - Unknown. Assumed to be 1.5 males to females when estimating the number of wild spawners from redd counts.

Size Range - Primarily from spawning ground surveys with a few hatchery recoveries (WDFW database, 1987-98). Samples ranged from 60 centimeters (cm) to 127 cm in length. The hatchery would have data relative to the size of captive brood.

Migrational Timing - Precise migrational timing is unknown, however, Ray Johnson, retired WDFW Fish Biologist, reports that during tagging studies for pink salmon in the early 1960's, chinook were captured "infrequently" during seining operations near the river mouth beginning around July 20 (Ray Johnson, pers. comm.).

Spawn Timing and Range - Spawning chinook have been observed in the mainstem Dungeness River up to RM 18.7 and up to RM 5.0 in the mainstem Gray Wolf River since 1986. Historical spawning range in the Gray Wolf is thought to be to approximately RM 9.5. Spawn timing in the lower river (RM 0-6.4) begins in September, ending in early October. From RM 6.4 to 10.8, spawning generally occurs from late August through September. In the Upper Dungeness River (RM 10.8-18.7), spawning usually begins in mid-August and ends in early September (Bill Freymond, WDFW, unpublished

data).

Juvenile Life History - It is believed that the predominate juvenile life history pattern is to out-migrate as a subyearling with freshwater rearing time after emergence of around 5 to 8 months. However, chinook ranging in size from 6 to 10 centimeters were captured in a Jamestown S'Klallam's Life History study conducted in October, 1997 through March 1998, (Jamestown S'Klallam Tribe, March, 1998). Most were progeny of project released fish. This may indicate a life history preference towards yearling migration in at least a portion of juveniles, but this has not been verified. Smolt emigration timing has been measured by WDFW smolt traps from early June through early September (Dave Seiler, WDFW, unpublished data, 1997). Mainstem smolt traps have not been operated prior to June 11.

- Identify the ESA-listed population(s) that may be incidentally affected by the program.

Bull trout are listed as threatened in the Dungeness system. There may be some competition between juvenile bull trout and planted subyearling chinook, however, this has not been documented. Bull trout may actually benefit from large plants of chinook fry through increased prey availability.

Summer chum may be incidentally affected, but only 1 or 2 (on average) are seen in August when conducting chinook surveys (Bill Freymond, WDFW Regional Biologist, personal communication).

2.2.2) Status of ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds

Preliminary critical and viable population thresholds under ESA have been determined by the Technical Review Team (Co-managers TRT) at 500 and 925, respectively. NOAA Fisheries thresholds are undetermined at this time. The SaSI report (draft 2002) determined that status of the Dungeness River chinook population was "critical".

Critical and viable population thresholds under ESA have not been determined for summer chum as described in the Summer Chum Salmon Conservation Initiative (2000). The SaSI report (draft 2002, WDFW) determined the status of the summer chum population to be "unknown".

The SaSI report (draft 2002, WDFW) determined that the status of the Upper Dungeness

bull trout/dolly varden to be "healthy" and the Dungeness/Gray Wolf stock was "unknown".

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

Progeny to parent ratios - There is no progeny to parent ratios or survival by life-stage data for Dungeness River wild chinook. The returns of 1999 were the first 4 year old adult returns to the river but due to the small release numbers (13,000 fingerlings), the returns were not expected to be significant. 2000 was the first return of 4 year olds from a plant of 1.8 million fish. They were not trapped, but were allowed to spawn naturally. Carcass counts and otolith samples / mark samples, will be utilized to estimate the total survival to return of progeny of captive brood adults.

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Most recent 12 year estimates of annual spawning abundance estimates - The following table provides spawning escapement estimates for wild chinook salmon in the Dungeness River system for 1986-1999.

Dungeness River System Wild Chinook Escapements, 1986-2003.

Year	Escapement
1986	238
1987	100
1988	335
1989	88
1990	310
1991	163
1992	153
1993	43
1994	65
1995	163
1996	183
1997	50
1998	110
1999	75
2000	218

2001	453
2002	633
2003	640

The wild chinook annual escapement goal is 925.

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Data from otoliths and heads recovered on the spawning grounds in 2001 have not yet been analyzed. Preliminary data, from 2000 returns, seem to indicate that a majority of spawners (+ or - 90%) are of hatchery origin.

2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

Broodstock collection directed at odd year fall-run pink salmon (not occurring at this time) has the potential to take listed spring/summer chinook through migrational delay, capture, handling and upstream release during trap operation in the lower mainstem from early August through mid- September. The pink weir will be installed at RM 0.4. The trap design will allow chinook to be released upstream without handling. The trap will be manned 24 hours per day to facilitate the immediate release of the listed Dungeness River Chinook.

Broodstock collection will be directed at chinook adults starting in 2004. The preferred live adult adult chinook in-river capture methods will include: 1) capture at the Dungeness Hatchery trap (pond), 2) installing a trap at the Dungeness Hatchery outlet stream, 3) hoop trap in upper river near hatchery, 4) fish wheel or 5) the pink salmon weir that is in lower river in odd years. Backup in-river egg collection methods will include: 1) gaffing, snagging or netting adults from redds and/or 2) pumping eggs from redds.

Spawning ground surveys will include otolith sampling, scale sampling and recovering tags from carcasses and will not lead to a take.

For the Captive Brood, held at Hurd Creek, there was a low risk of "take" of adult broodstock by loss from disease or water system failure. There was also a low risk of loss during transport to the Dungeness Hatchery for final maturity in July and August. There was a low risk of natural pre-spawning mortality and unintentional loss potential associated with adult spawning, egg incubation, and fry to fingerling rearing. All captive brood spawners were kill-spawned for the purpose of gamete collection and mating. Normal hatchery related mortality had no net negative impact on the stock as the majority of the fish survived to be released into the system. For the 1993 to '96 brood, fish which were reared in the South Puget Sound Net Pens, the green egg to eyed egg losses were very high and ranged from 16.9% to 58.2%. This compared with the freshwater counterpart which had "normal" green egg to eyed egg losses of less than 5%. The saltwater portion of this program was discontinued as a result.

The Dungeness River auxiliary intake (siphon) is not currently compliant with State or Federal withdrawal guidelines. In the past it was operated only on an intermittent basis, in the late summer when the low flow channel abandons the side of the river where the screened gravity intake is located. To avoid possible "take" concerns, this intake has not been operated since 1999. The Dungeness River Hatchery intake was identified as a high-priority capitol project for the 2001-03 fiscal biennium. Effective February 2001, Hatchery Scientific Review Group (HSRG) funds have been committed to begin scoping, design and construction work for a new compliant intake system. A private consultant firm has been hired to begin the preliminary project scoping work. The take risk is low now as the siphon intake will be operated only on an emergency basis at times when winter icing conditions or late summer low flows put the Dungeness River Chinook stock recovery program, located at the hatchery, at risk or make operation of the other gravity intakes impossible or ineffective.

The Canyon Creek intake is not equipped with a fish ladder. The Hatchery Scientific Review Group (HSRG) has recommended that the hatchery look for alternate warmer water sources to facilitate achieving proper time and size of release of the program fish. If an alternate water supply is found the HSRG has recommended that the Canyon Creek intake be removed or remodeled to allow fish passage into Canyon Creek. Two test wells drilled in 2002 proved unsuccessful in achieving that goal. In the interim, Hurd Creek Hatchery is used to accelerate a portion of the program fish. A consulting firm has been hired to scope possible water supply options for the hatchery.

Summer chum may be incidentally affected, but only 1 or 2 (on average) are seen in August when conducting chinook surveys (Bill Freymond, personal communication).

In addition, see sections 12.4, 12.5, 12.8 and 12.9 for a research related "take" using mature captive broodstock.

Note: See 6.2.3 for information regarding the initial "take". I. E. the original egg collection from wild redds to secure brood for the captive brood program.

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

See "take" table 1.

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

NOAA Fisheries, TAC and appropriate co-managers will be informed as early as possible. The actions which result in unexpectedly high take levels will cease as quickly as possible.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

The Captive Broodstock hatchery program was operated consistent with the Dungeness River Chinook Salmon Rebuilding Project Progress Report, 1992-93. The Jamestown S'Klallam Tribe and WDFW have developed a new supplementation program to begin in 2004 with the collection of adult broodstock from the river. Fish production is consistent with the current Future Brood Document. Hatchery operation and fish production goals are reviewed and adjusted as needed by the Dungeness Chinook Technical Advisory Committee annually. (See section 2.1 for further discussion)

The Summer Chum Salmon Conservation Initiative (2000).

The Dungeness Hatchery spring chinook salmon program HGMP is included as one of 30 WDFW-managed plans under the co-managers' Resource Management Plan (RMP) for Puget Sound region chinook salmon hatcheries. This HGMP is in alignment wth the RMP, which serves as the overarching comprehensive plan for state and tribal chinook salmon hatchery operations in the region.

As affirmed in the co-managers' RMP, WDFW hatchery programs in Puget Sound must adhere to a number of guidelines, policies and permit requirements. These constraints are designed to limit adverse effects on cultured fish, wild fish and the environment that might result from hatchery practices. Following is a list of guidelines, policies and permit requirements that govern WDFW hatchery operations:

Genetic Manual and Guidelines for Pacific Salmon Hatcheries in Washington. These guidelines define practices that promote maintenance of genetic variability in propagated salmon (Hershberger and Iwamoto 1981).

Spawning Guidelines for Washington Department of Fisheries Hatcheries. Assembled to complement the above genetics manual, these guidelines define spawning criteria to be used to maintain genetic variability within the hatchery populations (Seidel 1983).

Stock Transfer Guidelines. This document provides guidance in determining allowable stocks for release from each hatchery. It is designed to foster development of locally-adapted broodstock and to minimize changes in stock characteristics brought on by transfer of non-local salmonids (WDF 1991).

Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. This policy designates and delineates Fish Health Management Zones and defines inter and intra-zone transfer policies and guidelines for eggs and fish. These are designed to limiting the spread of fish pathogens between and within watersheds. (WDFW, NWIFC, USFWS 1998).

National Pollutant Discharge Elimination System Permit Requirements. This permit sets forth allowable discharge criteria for hatchery effluent and defines acceptable practices for hatchery operations to ensure that the quality of receiving waters and ecosystems associated with those waters are not impaired.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

In June, 1995, a Memorandum of Understanding (MOU) was developed jointly by WDFW, Jamestown S'Klallam Tribe, USFWS and USFS. This document sets forth the objectives and methods of operation for this program. The goals were established in an agreement entitled "Chinook Salmon Rebuilding Project in the Dungeness River", signed by all parties on June 14, 1994. The HGMP is a direct reflection of these plans and agreements. A plan for the adult broodstock collection/supplementation program is currently in draft form, soon to be finalized by WDFW and the Jamestown S'Klallam Tribe.

This hatchery, as well as other WDFW hatcheries within the Puget Sound Chinook ESU, operates under *U.S. v Washington* that provides the legal framework for coordinating these programs, defining artificial production objectives, and maintaining treaty fishing rights through the court-ordered Puget Sound Salmon Management Plan (1985). This co-management process requires that both the State of Washington and the relevant Puget Sound Tribe(s) develop program goals and objectives and agree on the function, purpose and release strategies of all hatchery programs (two brood documents are reviewed and agreed to annually. The Future Brood Document is a detailed listing of annual production goals. This is reviewed and updated each spring and finalized in July. The Current Brood Document reflects actual production relative to the annual production goals. It is developed in the spring after eggs are collected). WDFW and the Jamestown S'Klallam Tribe have developed an agreed upon an approach, as described in: *Dungeness River Chinook Salmon Rebuilding Project; Progress Report 1992-93; WDFW, Jamestown S'Klallam Tribe, USFWS Project Report Series #3, 1995*).

Two additional processes that involve co-managers include the "Annual Management Framework Plans" and "Salmon Run Status" reports for the Strait of Juan de Fuca, and the "Annual Winter and Summer Steelhead Forecasts and Management Recommendations", both are authored by the PNPTC, WDFW and Makah Tribe.

3.3) Relationship to harvest objectives.

No harvest is presently directed on this stock. Although some of the adults were tagged as juveniles (coded-wire tag and/or adipose-fin clip) in the past, there are currently no external marks which might identify these fish for selective fisheries. Terminal fisheries for all species have been curtailed in the Dungeness River and marine areas in the proximity of the Dungeness River to minimize direct or incidental impacts, due to harvest, on chinook. Harvest opportunity is the long range objective, both direct and indirect, when recovery at Maximum Sustainable Yield (MSY) levels are attained.

WDFW run reconstruction data shows harvest for the past 12 years as follows:

Year	Area 6D Catch
1988	5
1989	1
1990	0
1991	19
1992	1
1993	1
1994-99	0

3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

There is no targeted fishery on this stock at this time and only low levels of incidental harvest are permitted in southern U.S. fisheries. Preseason forecasts in recent years have indicated that the Dungeness River chinook stock remains at critical abundance levels (<500 adult spawners). With this forecast of critical abundance, the plan (Puget Sound Comprehensive Chinook Management Plan) limits southern U.S. fisheries to an incidental exploitation rate not to exceed 6%. Actual run sizes have been greater than 500 with escapements of more than 600 adults in each of 2002 and 2003. When escapements are forecasted to be greater than 500 chinook, incidental exploitation rates on Dungeness chinook in southern U.S. waters will be limited to not exceed 10%.

3.4) Relationship to habitat protection and recovery strategies.

Long-term recovery of this stock will be largely dependent upon the ability to restore fish habitat in the Dungeness River. Habitat problems include water removal for irrigation, dikes in the lower river, scouring and poor gravel recruitment or gravel aggradation. These result in poor spawning and rearing habitat for salmon. This captive brood program will protect the population from further decline by removing them from many of the root causes of their decline. Without significant habitat improvement, the Dungeness River chinook are not expected to achieve full recovery and will require long-term supplementation (see section 1.8).

3.5) Ecological interactions.

(1) Salmonid and non-salmonid fishes or other species that could negatively impact the program.

Negative impacts by fishes and other species on the Dungeness Hatchery chinook program could occur directly through predation on program fish, or indirectly through food resource competition, genetic effects, or other ecological interactions. In particular, fishes and other species could negatively impact Dungeness chinook survival rates through predation on newly released, emigrating juvenile fish in the freshwater and marine areas. Certain avian and mammalian species may also prey on juvenile chinook while the fish are rearing at the hatchery site, if these species are not excluded from the rearing areas. Species that could negatively impact juvenile chinook through predation include the following:

- Avian predators, including mergansers, cormorants, belted kingfishers, great blue herons, and night herons

- Mammalian predators, including mink, river otters, harbor seals, and sea lions

Rearing and migrating adult chinook originating through the program may also serve as prey for large, mammalian predators in marine areas, nearshore marine areas and in the Dungeness River to the detriment of population abundance and the program's success in restoration. Species that may negatively impact program fish through predation may include:

- Orcas
- Sea lions
- Harbor seals
- River otters

(2) Salmonid and non-salmonid fishes or other species that could be negatively impacted by the program (focus is on listed and candidate salmonid species).

- Dungeness spring chinook (listed)
- Summer chum salmon (listed)
- Pink salmon

3) Salmonid and non-salmonid fishes or other species that could positively impact the program.

Fish species that could positively impact the program may include chinook salmon and other salmonid species present in the Dungeness River watershed through natural and hatchery production. Juvenile fish of these species may serve as prey items for the chinook during their downstream migration in freshwater. Decaying carcasses of spawned adult fish may contribute nutrients that increase productivity in the watershed, providing food resources for the emigrating chinook.

4) Salmonid and non-salmonid fishes or other species that could be positively impacted by the program.

Freshwater and marine fish species that prey on juvenile fish could be positively impacted by the chinook program. Nutrients provided by decaying chinook carcasses may also benefit fish in freshwater. These species include:

- Northern pikeminnow
- Chinook, pink and summer chum salmon

- Steelhead
- Pacific staghorn sculpin
- Numerous marine pelagic fish species

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

The water source for this program is surface water from the Dungeness River. It is the same as the natal water used by the natural spawning population. It is of good quality except during times of flooding when it become quite silty due to upriver slides. A second intake on Canyon Creek, a Dungeness River tributary, is used routinely but is especially valuable in the event the Dungeness becomes excessively silty or clogged with anchor ice. The Canyon Creek intake is not equipped with a fish ladder. The Dungeness is a very cold water system, prone to icing in the winter, thus slowing growth of the fish.

The Hatchery Scientific Review Group (HSRG) has recommended that the hatchery look for alternate warmer water sources to facilitate achieving proper time and size of release of the program fish. If an alternate water supply is found the HSRG has recommended that the Canyon Creek intake be removed or remodeled to allow fish passage into Canyon Creek. Two test wells drilled in 2002 proved unsuccessful in achieving that goal. In the interim, Hurd Creek Hatchery will be used to accelerate a portion of the program fish. A consulting firm has been hired to scope possible water supply options for the hatchery.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

The Dungeness River auxiliary intake (siphon) is not currently compliant with State or Federal withdrawal guidelines. In the past it was operated only on an intermittent basis, in the late summer when the low flow channel abandons the side of the river where the screened gravity intake is located. To avoid possible "take" concerns, this intake has not been operated since 1999. The Dungeness River Hatchery intake was identified as a high-priority capitol project for the 2001-03 fiscal biennium. Effective February 2001, Hatchery Scientific Review Group (HSRG) funds have been committed to begin scoping, design and construction work for a new compliant intake system. A private consultant firm has been hired to begin the preliminary project scoping work. In the interim, the siphon intake will be operated only on an emergency basis and at times when winter icing conditions or late summer low flows put the Dungeness River Chinook recovery

program, located at the hatchery, at risk or make operation of the other gravity intakes impossible or ineffective.

The usage of surface water from the Dungeness River is regulated under the following permits:

Water right permit # 3518 - 1944 (25CFS)
" # S2-21709C - 1973 (15CFS)

A second intake, on Canyon Creek, a Dungeness River tributary, is used routinely but is especially valuable in the event the Dungeness becomes excessively silty or clogged with anchor ice. Its' permit # is:

Water right permit # S2-00568C - 1970 (8.5CFS)

The Dungeness Hatchery has an off-line settling pond and artificial wetland for effluent removal before the water is discharged back into the river (regulated through NPDES permit # WAG 13-1037).

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Dungeness Hatchery has an off-channel adult pond. There is no in-river rack on the Dungeness River which might prevent adults from passing upstream naturally. All fish to the hatchery trap are volunteers and are primarily hatchery coho. Any adult spring chinook volunteering to the trap will be returned to the river above the outfall, or hauled and released into the upper watershed to spawn naturally, or because of a male shortage, some males may be live-spawned with captive broodstock females before being returned to the river (2003 only). Scales will be taken from live spawned males and they will be PIT tagged before being released back into the river. The intent is that all adults which return to the river be allowed to spawn naturally.

Beginning in 2004, adult chinook will be collected from the Dungeness Hatchery trap (pond) and from the hatchery outlet stream and used as adult broodstock as part of the continued supplementation program.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

The Dungeness Complex has four tanker trucks: a 1200 gallon, 900, 700 and a 400 gallon tank used for fish transport.

5.3) Broodstock holding and spawning facilities.

Hurd Creek rears the captive broodstock in 20 foot diameter fiberglass circular ponds. They are transferred to the Dungeness Hatchery for spawning. They are transferred when they begin to show the external signs of sexual maturation: color or morphology. They are normally transferred in late July or early August. The fish are held for several weeks to up to two months prior to spawning in 10' X 100' concrete raceways.

Broodstock that are collected live in 2004, and in subsequent years, will be held until ripe at the Dungeness Hatchery in 10' X 100' concrete raceways. Broodstock gaffed from redds in the river will be spawned on-site and eggs transferred to the Dungeness/Hurd Creek facility.

5.4) Incubation facilities.

Incubation at Dungeness consists of 72 stacks of vertical (FAL) vertical incubators.

5.5) Rearing facilities.

Dungeness has 10 standard 10' X 100' concrete raceways, 16 indoor 16' fiberglass starter ponds and a ½ acre dirt pond. Hurd Creek has 40' fiberglass raceways, 4' and 10' fiberglass circular ponds and various dirt ponds. The Gray Wolf pond is a natural dirt pond setting.

5.6) Acclimation/release facilities.

Chinook yearlings are currently reared and released from the Dungeness Hatchery. Hurd Creek acclimates and releases yearlings on site. The Gray Wolf pond is a natural setting acclimation pond for upriver releases of progeny from captive brood chinook. All other chinook are released without acclimation. See 1.11.2 for detailed release information.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

NA

5.8) Indicate available back-up systems, and risk aversion measures that will be applied,

that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

The hatcheries are staffed full-time, with 24 hour stand-by, and equipped with many low-water alarms which help prevent catastrophic fish loss resulting from any type of water system failure. Pumping power would be provided with an emergency backup generator (at Hurd Creek only), equipped with an auto start, in the event of loss of normal power. The generator is capable of providing power to all hatchery components indefinitely, with fuel supplied as needed. Onsite fuel storage capacity is 1490 gallons, a seven day supply at full generator load. Further, a surface water backup supply from Hurd Creek can be supplied to the 20 foot rearing ponds in the unlikely event of total loss of all power sources.

Dungeness Hatchery uses gravity-fed water from 3 different sources. Any of these can be used in the event of anothers' failure.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

Broodstock is native to the Dungeness River and was collected from the river, via redd pumping during the 1992-1997 brood years. Mature captive brood have provided the only egg source since 1996. See 6.2.3 below.

In 2004, broodstock will be collected from naturally returning adults in the Dungeness River.

6.2) Supporting information.

6.2.1) History.

The Dungeness River chinook population consists of a wild chinook stock that is considered to be native in origin and is listed as “critical” in the 1992 Washington State Salmon and Steelhead Stock Inventory (SASSI) (WDFW et al., 1992). The Dungeness Wild Chinook Restoration Committee and SASSI participants concluded it is likely there is a single chinook salmon stock in the Dungeness Basin. The impact of past releases of non-native chinook stocks into the Dungeness River between 1966-1972 is unknown.

6.2.2) Annual size.

Native broodstock will not be collected for the remainder of the captive broodstock program. The sole source of eggs will be from the Captive Brood adults held at Hurd Creek. The source of eggs, beginning in 2004, will be from naturally returning adult chinook collected from the river and the Dungeness Hatchery trap.

One of the best estimates of past stock size comes from old hatchery records. From the 1930s to 1981 an anadromous broodstock program existed at the Dungeness Salmon Hatchery. During the 1940's and 50's, a return of about 300 fish per year were reported returning to the hatchery. A peak of 1,305 fish was recorded in 1959 but dropped in following years and remained low. During that time Dungeness chinook were spawned, incubated, reared and released back into the Dungeness river without sustainable increases being noted in adult returns.

The 1995 to 1999 average of the natural spawning population has been around 114 fish; sex ratios are not known. The captive brood population has averaged from 1,000-1,500 fish (all age classes) during the past 2 complete spawn years (1998 and 1999). The number of females have been between 500 and 730. See section 1.11.1 for recent captive brood numbers.

Sex ratio of the captive spawning population was 1:1 from 1995-99. The ratio has ranged from 0.29 to 0.36 male per female in 2000-02. Jacks and adult males volunteering to the hatchery trap are used.

6.2.3) Past and proposed level of natural fish in broodstock.

The captive brood program originally acquired naturally spawned eggs from the river. These were groups of pre-emergent fry, or eyed eggs (families) that were extracted from known chinook redds using a hydraulic redd sampler. The following table summarized the egg and fry collection activities and disposition of the fish:

HURD CREEK DUNGENESS CHINOOK BROODSTOCK

Brood Year	Initial Take Fry	Initial Take Eggs	Egg Incubation Loss	Pre-tag Fry Loss	Return to River	To Salt wtr	Fresh wtr Tagged	2 yr Loss	Jacks
92	5469			935	840	0	3694	32	621
93	1607			87	0	733	787	7	106
94	2327	1584	85	95	1341	1185	1205	79	133
95	71	6047	201	38	3493	1197	1189	6	127
96	0	4130	392	55	1878	612	1193	10	189
97	0	1751	119	53	390	0	1189	5	104

Brood Year	3 yr Loss	3 yr spawners		3 yr Mature Mortality		4 yr Loss	4 yr spawners		4 yr Mature Mortality	
		Males	Females	Males	Females		Males	Females	Males	Females
92	676	162	9	0	0	96	306	514	?	?
93	45	24	6	0	0	17	102	188	0	0
94	42	216	7	12	2	23	111	343	2	14
95	25	83	7	5	1	8	173	259	11	12
96	27	170	38	39	2					
97										

Brood Year	5 yr Loss	5 yr spawners		5 yr Mature Mortality		6 yr Loss	6 yr spawners		6 yr Mature Mortality	
		Males	Females	Males	Females		Males	Females	Males	Females
92	131	237	471	?	?	11	38	28	1	3
93	53	48	85	5	20	11	19	27	0	3
94	15	49	102	4	16					
95										
96										
97										

Brood Year	7 yr Loss	7 yr spawners		7 yr Mature Mortality ***	
		Males	Females	Males	Females
92	0	0	0	114	244
93	we may have some in 2000 from '93 brood				
94					
95					
96					
97					

Mature mortality accounts for mature fish that are not fit to spawn, surplus to needs or died prior to spawning.

***'92 Brood mature mortality is high due to transfer of bright fish from Hurd Creek to Dungeness during a water shortage at Hurd Creek.

Eggs and Fry Collected and Families Represented

Brood Year	Number of Eggs / Fry Collected	Number of Families
1992	5,469 fry	19
1993	1,607 fry	12
1994	2,327 fry 1,584 eggs	15
1995	71 fry 6,047 eggs	40
1996	4,130 eggs	46
1997	1,751 eggs	9

In brood years '94 thru '97 all surplus live fry in excess of the goal of 1200 fish for the captive brood program were returned to the river, at the original location of their collection.

6.2.4) Genetic or ecological differences.

Since considerable care was taken to achieve a representative number of families, it is expected that the brood source will have no genetic differences from the natural spawning population. Progeny of the captive brood program that are released into the natural environment may exhibit behavioral differences since the fish are reared in artificial conditions. Limited genetic data are available for the "wild" population. However, additional samples are collected each year. Captive brood spawning peaks approximately 1-2 weeks later than wild fish.

6.2.5) Reasons for choosing.

Native stock.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

The risk of within population genetic diversity loss will be reduced by selecting the indigenous

chinook salmon population for use as broodstock in the supplementation program. Also, by limiting the length of the captive broodstock program to the 1992 through 1997 broods, adverse genetic or ecological effects to listed natural fish are minimized.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

The life stage collected to develop the captive broodstock program was eyed eggs and pre-emergent fry (1992-1997). Beginning with the 2004 BY, adults will be collected and spawned artificially to develop zero-age and yearling plants in future years.

7.2) Collection or sampling design.

Broodstock collection for the Captive Broodstock program began in 1992 and was terminated in 1997. The original life stage targeted in 1992 was pre-emergent fry. Eyed eggs were collected from 1993 to 1997. The method of extracting the eggs and fry was by use of a hydraulic jet of water injected into the gravel substrate. Prior to egg extraction, chinook redds were identified for later collection efforts. Temperature units (TU's) were monitored with the goal of collecting eggs with 500 to 750 TU's of development ("eyed eggs") from each redd. The number of eggs to be collected from each redd was determined by the number of redds identified. The ultimate goal was to have approximately 1200 captive brood adult spawners, after normal rearing loss for 2 to 5 years, representing as many family groups possible (one redd = one family group). Typically, about 50% of the nests were "false" redds and produced no eggs. Commonly, 60 to 100 eggs were collected from each true redd. Collection efforts were stopped when the target number of eggs was collected. The range of eggs or fry collected was from 90 to 288 per redd with the average being 163 per redd. There was no known mortality associated with the egg or fry collection.

In 2004, adults will be collected from the river. Collection options are: trapping, spawning the last 13 captive broodstock, gaffing, snagging or netting. Fertilized eggs will be held at the Hurd Creek facility. Rearing will take place at both facilities. Projected eggs per female is approximately 4,000. The goal is to collect up to 222,000 eggs from about 56 females.

7.3) Identity.

The Dungeness River has been determined to be one distinct population (SASSI '92).

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

In the later years of the captive broodstock project (2000-02), the sex ratio in the captive brood population has averaged 0.33 males per female.

The sex ratio goal for adult collection in 2004 is 1:1.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available: (These are the number of captive broodstock used for spawning in this program (includes mortalities)).

See section 6.2.3.

Captive Broodstock Spawned:

Year	Adults			Eggs	Juveniles released
	Females	Males	Jacks		
1988					
1989					
1990					
1991					
1992					
1993					
1994					
1995					
1996	527	323	224	1,889,630	1,774,536
1997	876	729	146	2,565,000	2,049,895
1998	592	600	217	2,030,600	1,775,152
1999	332	608	355	2,148,800	2,062,000
2000	633	299		2,525,000	2,084,780
2001	399	272		1,596,000	
2002	166	101		625,800	

*See section 1.11.1 for more recent numbers of captive brood remaining/used for spawning.

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

There is no surplus for this program.

7.6) Fish transportation and holding methods.

Adults in the captive broodstock program are transported from the Hurd Creek Hatchery to the Dungeness Hatchery. The fish are transported when they exhibit external signs (color and morphology) of maturation, normally in late July to early August. Transit takes about an hour from the time of initial loading to unloading. As a buffer, to minimize hauling stress, rock salt is added to the hauling water to achieve a 5% saltwater solution. At Dungeness, female adults are injected with 20mg/kg erythromycin for Bacterial Kidney Disease (BKD) control and all fish are injected with 20mg/kg oxytetracycline for gram-negative enteric bacteria control. Adults are treated daily with 167 parts per million (ppm) formalin for Saprolegnia fungus control. Most fish are hauled about one month prior to spawning. The fish are treated with formalin three times per week at a rate of 1:6000 drip for one hour. On alternate days the fish are treated with copper sulfate at 1 ppm for a one hour drip.

Live adults collected in 2004, and subsequent years, will be transported to the Hurd Creek Hatchery where they will be held in circular tanks until ripe. Eggs taken from adults spawned on the river will be also taken to the Hurd Creek facility. Prophylactic treatments for live adults will be the same as stated in the paragraph above for the captive broodstock adults. No copper sulfate will be used in the future. Formalin will be used for daily fungus control.

7.7) Describe fish health maintenance and sanitation procedures applied.

See section 7.6

7.8) Disposition of carcasses.

All carcasses are distributed back to the Dungeness River watershed for nutrient enhancement.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

As many family groups as possible were collected to maximize the genetic diversity within the Captive Broodstock and to minimize the risk of inbreeding. Pumping the eyed eggs from the redd has no known negative effects on either the eggs withdrawn or the eggs remaining in the gravel. The number of eggs withdrawn from each redd is/was a small portion of the total egg mass deposited by the wild female.

Genetic diversity was maximized in the captive broodstock program. The progeny from that

program, returning as adults to the river in the next few years, should be equally genetically diverse. Adults collected in 2004, and in subsequent years to be used for continued supplementation, should also represent that same genetic diversity.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

Note: This section refers to both the spawning of the "Captive Brood Reared Adults" and wild adults that are captured.

8.1) Selection method.

All available spawners are utilized and are chosen, at random and without consideration for age or size, as they become mature.

8.2) Males.

In the first four years of the project (1995-99), individual males were spawned with single females (pair matings). No gametes were pooled prior to fertilization. Since 2000, the male to female ratio has averaged 0.33:1, one male is used to fertilize multiple females. All captive brood fish are killed prior to spawning. In 2003, males that volunteer to the hatchery trap may be live spawned with captive brood females, scale sampled, PIT tagged and returned to the river. See section 1.11.1 for more recent numbers of captive brood remaining/used for spawning.

A 1:1 ratio of males to females will be the goal of the continued supplementation program beginning in 2004.

8.3) Fertilization.

In 1995-99 fish were spawned at a 1:1 sex ratio. Gametes were not pooled until the eggs and sperm had set for several minutes. Fertilized gametes were then pooled into female pools of three for incubation. This is the goal of the continued supplementation program to begin in 2004.

Since 2000, the spawning sex ratio has averaged 0.33:1 male per female in the captive broodstock program.

8.4) Cryopreserved gametes.

NA

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse

genetic or ecological effects to listed natural fish resulting from the mating scheme.

Geneticists working with the TAC have determined that the a factorial mating scheme was not necessary due to the large numbers of families, large numbers of spawners, and the variety in spawning year classes (2's , 3's, 4's, 5's and some 6's). The family and age of each parent fish is determined after the matings have occurred.

Genetic diversity was maximized in the captive broodstock program. The progeny from that program, returning as adults to the river in the next few years, should be equally genetically diverse. Adults collected in 2004, and in subsequent years, to be used for continued supplementation, should also represent that same genetic diversity.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Five year summary of egg production and survivals from green eggs to ponding

Year	1995-1999 Dungeness Chinook Egg Data					
	Eggs Taken	Egg Loss	% Egg Loss	Fry Loss	% Fry Loss	Fry Ponded
1995	42,803	9,914	23.16	11,797	35.9	21,092
1996	1,889,630	92,130	4.88	83,000	4.6	1,714,500
1997 FW	2,371,800	170,400	7.18	53,100	2.4	2,148,300
1997 SW ***	193,200	84,500	43.74	12,100	11.1	96,600
1998 FW	1,970,600	109,200	5.54	41,061	2.2	1,820,339
1998 SW ***	60,000	19,000	31.67	2,100	5.1	38,900
1999 FW	1,549,200	130,700	8.44	70,400	5.0	1,348,100
1999 SW ***	599,600	251,900	42.01	60,400	17.4	287,300

*** Note: Some captive brood were originally reared in seawater (SW = seawater) pens at Squaxin Island. This strategy was abandoned due to excessive egg loss.

9.1.2) Cause for, and disposition of surplus egg takes.

All available adults will be spawned and all available eggs will be cultured. All fry surplus to the release needs as specified in section 10.1 shall be cultured at the Dungeness Hatchery for release into the Dungeness River. Fish which exceed the full rearing capabilities of the Dungeness

River Hatchery will be planted into Dungeness River or Gray Wolf River sites as agreed upon by the Dungeness River Technical Team.

9.1.3) Loading densities applied during incubation.

The eggs are put down to hatch, in vertical incubators with artificial substrate, at 7,500 per tray. Flow is set at 4 gallons per minute (gpm) per ½ stack. Egg size has varied between 1590 and 5172 eggs per pound.

9.1.4) Incubation conditions.

Incubation is done in vertical stack incubators. The ambient river water is clarified in a settling pond. Temperatures range between 32 and 45 degrees Fahrenheit. Dissolved oxygen is saturated at approximately 11 ppm. Eggs and/or fry in the incubators are monitored daily for the correct rearing parameters.

9.1.5) Ponding.

Button-up fry are force ponded when yolk is approximately 95-100% absorbed. This is done with a visual check of a dozen fry. Temperature units at this time are approximately 1700.

9.1.6) Fish health maintenance and monitoring.

The fish/eggs at Dungeness are monitored by a WDFW Fish Health Specialist on a routine basis. Eggs are treated daily with a formalin drip at 1667 ppm for fungus prevention. Dead eggs are either hand picked or salt dipped.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

The Dungeness Hatchery has a settling pond which filters out the majority of the silt. The eggs (collected from a diverse group of families) are watched daily to insure that there are no silt problems occurring. The incoming water is alarmed in various places to insure all the water needs are met.

9.2) <u>Rearing</u>:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available..

Captive Brood:

Redd pumped eyed egg to fry survival from 1994-1997 averaged 93.75%.

Progeny of Captive Brood:

Green to eyed egg survival = 93.45% for fresh water and 58.33% for salt water.
Ponding to release survivals average 97.1% for brood years 1995 to 1998.

9.2.2) Density and loading criteria (goals and actual levels).

All fish at either the Dungeness Hatchery or Gray Wolf pond are reared within the loading guidelines set forth in the "Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State" and Piper's Fish Hatchery Management Manual.

9.2.3) Fish rearing conditions

Captive brood family units are kept separate until large enough to tag (about 200 fish/lb.)Family sizes are equalized (to the extent possible) when reducing the population to the 1200 fish limited for the rearing program. All families are then combined into one unit. Initially, due to the experimental nature of freshwater captive brood rearing for chinook, the seawater survival rates observed in the White River captive brood program were used to estimate expected survival rates for this program. The survival rates have been much better than expected for all freshwater life stages.

In 1993, 94 and 95, 50% of the Dungeness River Captive Broodstock were reared in salt water net pens at the South Sound Net Pen (SSNP) site. The survival of this portion of fish reared in saltwater was equal to other captive broods reared at SSNP (White River Chinook) (See table at 6.2.4). However, the marine-reared Captive Brood egg loss was higher than the fresh water egg loss, averaging 41.7% to the eyed stage and fry loss at 18.8% (1997-1999 data). As the goal of this program is to achieve the highest possible egg and fry survival, within biological norms, the saltwater rearing portion of this program was discontinued.

As of April 24, 2001 there are approximately 300+ captive broodstock on hand at Hurd Creek. These will be 5 and 6 year old fish in 2002. At this time it is not possible to assess the sex ratio of these fish. Based on past maturation rates and history it is expected that a majority of the fish will mature in 2002 with a potential egg production of 400,000 to 500,000 eggs. The balance, will likely spawn in 2003 with a small but unknown egg potential.

Progeny are reared in 10' X 100' standard ponds which are cleaned weekly. Water parameters are the same as 9.1.4 above. Losses are picked and recorded daily. Fish are examined by the area Fish Pathologist on a monthly basis unless needed otherwise.

9.2.4) Indicate biweekly or monthly fish growth information (*average program*

***performance*), including length, weight, and condition factor data collected during rearing, if available.**

Not available.

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

Not available.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Feed types used are Bioproducts and Skretting. Fish are fed according to the feed manufacturers recommendations and the expertise of the Fish Specialists. Overall conversions have varied between .75 and 1.5 depending on the feed used and the size of the fish. Captive brood are fed a broodstock formulation.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

The fish are monitored on a monthly basis by the area Fish Health Specialist or as needed. Disease treatments are prescribed by the Fish Health Specialist as needed.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

External cues (silver color) and behavioral changes (migration urges) are used to determine the degree of smoltification of the chinook.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

Progeny of captive brood are reared using several different approaches prior to release. Some are reared to smolts using standard 10' X 100' raceways. Others are planted as fed fry into available habitat as deemed appropriate by the TAC. In addition, use is made of an acclimation pond located on Gray Wolf River (a major Dungeness River tributary above the hatchery) for both short-term rearing of fingerlings and rearing of migrant smolts.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

As is noted in 9.2.9, several rearing methods are employed. In the event that one method should fail as a productive enhancement tool, the other rearing method(s) will act as a potential

enhancement back-up.

As a standard, these fish will be reared to sub-yearling (fingerling) and yearling smolt size (from supplementation program, 2004 BY) to mimic the natural fish migration habits and to minimize the risk of domestication.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Note: As the Captive Brood egg source diminishes in the future, the following release strategies (see table and text below) will be dropped in the following order: Option A, option C, option B, and option D. E, F and G will continue as per Table 2 below.

Table 1.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry	A. 200,000 (3) B. 400,000 (3) C. 200,000(2) D. 200,000 (3)	450 250 250 200	May June/July June/July June/July	Grey Wolf River Gray Wolf River Dungeness River Gray Wolf River
Fingerling	E. 50,000 50,000	40	May/June(6)	Gray Wolf River(4) Dungeness River(2)
Yearling	F. 100,000 G. 100,000	8 to 10 8 to 10	April(6) April(6)	Dungeness River(1) Hurd Creek(5)

450 fpp ~ 47 mm fork length
250 fpp ~ 56 mm fork length
200 fpp ~ 60 mm fork length
40 fpp ~ 99 mm fork length
10 fpp ~160 mm fork length
8 fpp ~171 mm fork length

Fish releases from annual broodstock collection beginning in 2004 BY**(Table 2).

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Fingerling (Zero-age)	0-50,000 0-50,000	40	May/June	Dungeness R. Gray Wolf R.
Yearling	50,000-100,000 50,000-100,000	8-10 8-10	April April	Dungeness R. Hurd Creek

10.2) Specific location(s) of proposed release(s).
Stream, river, or watercourse:
Release point:
Major watershed:
Basin or Region:

(1) Dungeness River (18.0018) at Dungeness Hatchery RM 10.5, Dungeness River, Puget Sound.

(2) Dungeness River (18.0018) at various locations in the upper watershed, Dungeness River, Puget Sound

(3) Gray Wolf River (18.0048) at various locations in the upper watershed, Dungeness River, Puget Sound

(4) Gray Wolf River (18.0048) from the Gray Wolf Acclimation Pond RM 1.0, Dungeness River, Puget Sound

(5) Hurd Creek Hatchery (18.0028) in the lower Dungeness River.

**(6) Release dates for the newly modified supplementation project (Table 2) for yearlings and accelerated zeros will be in April, May or early June. Yearling smolts will be released primarily in April when they show signs of strongest smoltification.

Marks applied to each group:

All rearing strategies will be differentially identified with internal indicators. They are:

A, B and D: Otolith mark only. No adipose clip.
C, E, F and G: blank or coded-wire tags only. No adipose clip.

* Note: See section 10.1 and 10.2 "Proposed Fish Release Levels" for the specific rearing and

release goals for each group.

10.3) Actual numbers and sizes of fish released by age class through the program.

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size fpp	Fingerling	Avg size fpp	Yearling	Avg size fpp
1988								
1989								
1990								
1991								
1992								
1993								
1994								
1995								
1996					13,013	123		
1997			421,452	250	1,353,084	145		
1998			577,500	436	1,472,395	148		
1999			777,628	222	997,524	117	**56,075	6
2000			146,304	330	1,354,812	130		
2001			555,380	350	1,529,400	110		
2002			831,100	255	309,300	53		
2003					578,928	62	107,450	9
Average			551,561	307	951,057	111	81,762	7.5

Note: ** These fish had originally been programmed to be planted into Morse Creek, a sub-unit of the GDU (genetic diversity unit) and a separate tributary of the Straits of Juan De Fuca..

10.4) Actual dates of release and description of release protocols.

1996	smolts	6/24, 8/30
1997	fry	6/24, 6/30, 7/9, 8/8
1997	smolts	7/14, 7/21, 8/1, 8/8
1998	fry	5/5, 5/12, 5/18, 6/12, 6/18, 7/6

1998	smolts	7/20, 7/25, 8/1, 8/8
1999	fry	6/1, 6/21, 6/29, 7/6
1999	smolts	8/3, 8/6, 8/11, 8/20
1999	yearlings	8/17 thru 8/27 volitional
2000	fry	5/30 thru 8/23
2000	smolts	6/26 thru 8/23
2001	fry	2/01 thru 9/23
2001	smolts	7/6 thru 9/6

These dates were chosen based on the size of the fish, their condition, the program release dates and the tagging operation. The fry releases were forced and the smolt releases were volitional then forced. Some releases were made directly into the river and others were made from the Gray Wolf acclimation site. See section 10.6.

Releases of progeny from adult collections (beginning in 2004) will consist of zero-age (fingerling) smolts in the late spring/early summer (2005) and yearlings in the spring.

10.5) Fish transportation procedures, if applicable.

The fish were hauled in tank trucks for up to one hour. They were hauled in ambient river water with salt added at the recommended rate of 0.5%. Salt acts as a buffering mechanism to reduce hauling-related stress. Tank loadings did not exceed the .33 pounds per gallon of water. Supplemental oxygen is added at the rate of 3.5 to 5 liters per minute.

The same standards will be used for the 2004 adult collection.

10.6) Acclimation procedures

All fish released via the Gray Wolf acclimation pond site receive two to four weeks of acclimation at Gray Wolf. All Hurd Creek and Dungeness Hatchery yearlings are reared entirely on Hurd Creek or Dungeness Hatchery water throughout rearing.

The same standards will be used for the 2004 adult collection progeny.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

All juvenile fish released are marked with either a coded-wire tag, an otolith mark, or blank wire

tags. Each planting strategy is identified with a distinct otolith marks, coded wire tags or blank wire tags to allow for separate evaluation of each particular strategy. Please see section 10.2 for further definition of the marking and tagging protocol.

All releases from the supplementation program beginning in 2004 will be CWT'd only. No adipose fin clips will be applied (as in the earlier stages of the program) since the Dungeness chinook program was implemented to increase the number of spawners, not provide fishing opportunities.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

NA

10.9) Fish health certification procedures applied pre-release.

The fish are checked by the area Fish Health Specialist before release.

10.10) Emergency release procedures in response to flooding or water system failure.

Drain the ponds and release the fish directly into the river at the hatchery sites.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

All sub-yearling and yearling smolts (from supplementation program) shall be released in a manner which minimizes domestication and mimics the natural out-migration patterns of wild Dungeness River chinook. Yearling smolts will be released primarily in April when they show signs of strongest smoltification.

To minimize the possible adverse interactions and ecological effects to pink salmon juveniles, all accelerated reared smolts will be released on or after June 1. This release date also minimizes the effect to listed natural chinook salmon juveniles, which rear in up-river areas and migrate seaward as sub-yearling smolts predominately in July to August.

In addition, the goal of the rearing and release program is to attain a coefficient of variation (CV) for length of 10.0% or less in order to decrease the likelihood that the growth or development of the largest segment of the population will be retarded. Such fish would be more likely to

residualize in fresh water and interact with listed wild fish. The average CV for release years' 1996-2002 was 9.14%.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

Note: See section 1.10 for Monitoring and Evaluation.

The purpose of a monitoring program is to identify and evaluate the benefits and risks which may derive from the hatchery program. The monitoring program is designed to answer questions of whether the hatchery is providing the benefits intended, while also minimizing or eliminating the risks inherent in the program. A key tool in any monitoring program is having a mechanism to identify each hatchery production group.

Note: WDFW has requested funding through the Hatchery Scientific Review Group (HSRG) process to monitor juvenile/smolt migration in the Dungeness River system. This is in response to the HSRG's recommendation to describe the life history patterns of Dungeness chinook; their distribution, abundance and migratory movements. A screw trap and staff to run it are the key elements of the request. The trap would be operated from April through September each year. The trap would expect to catch thousands of chinook migrants as well as other species. In 1997, a screw trap fished the lower Dungeness River from June 11 to September 8 and caught 62,867 zero-age chinook (1.774 million were released that same year). No funds have been appropriated at this time.

Each production group shall be identified with distinct otolith marks, adipose clips, coded wire tags, blank wire tags or other identification methods as they become available, to allow for evaluation of each particular rearing and/or release strategy. This will allow for selective harvest on hatchery stocks when appropriate, monitoring of interactions of hatchery and wild fish wherever they co-mingle in riverine, estuarine and marine habitats and assessment of the status of the target population. WDFW shall monitor the chinook salmon escapement into the target and non-target chinook populations to estimate the number of tagged, un-tagged and marked fish escaping into the river each year and the stray rates of hatchery chinook into the rivers.

Each planting strategy is identified with distinct otolith marks, coded wire tags or blank wire tags to allow for evaluation of each particular rearing and release strategy. WDFW shall monitor the chinook salmon escapement to the Dungeness River to estimate the number of tagged, untagged, and otolith marked fish escaping to the river each year. This monitoring will allow for

assessment of the status of the target population and the success of the program in achieving restoration objectives.

WDFW shall monitor chinook salmon escapement to the Dungeness River to estimate the number of tagged, untagged, and marked fish escaping to the river each years. This monitoring will allow for assessment of the status of the target population and the success of the program in achieving restoration objectives.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

See section 1.10 "Monitoring and Evaluation Plan" and section 11.1

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

Funding and resources are currently committed to monitor and evaluate this program via the TAC, WDFW and the Co-Managers and as detailed in the Resource Management Plan for Puget Sound Chinook Salmon Hatcheries (Washington Department of Fish and Wildlife and Puget Sound Treaty Tribes, August 23, 2002). Staffing and fiscal resources are limited though and WDFW funding is not available to expand either monitoring or evaluation of this program.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Monitoring and evaluation will be undertaken in a manner which does not result in an unauthorized take of listed chinook in the Dungeness River.

SECTION 12. RESEARCH

12.1) Objective or purpose.

Imperiled salmon (*Oncorhynchus spp.*) populations in the Pacific Northwest are increasingly being brought into captive culture environments for stock conservation or recovery. Captive populations of chinook salmon (*O. tshawytscha*) are established by removing eggs or juveniles from their natal habitats and culturing them to adulthood to bypass high juvenile to adult mortality (Waples and Do 1994; Flagg et al. 1995). When sexually mature, the adults in a captive culture program may be used in two different ways. Conventional captive broodstock programs rely on artificial spawning of the captively reared adults to produce large numbers of offspring

for further culture, or release into the wild. Alternatively, some programs release captively reared adults back into their natal streams to spawn naturally. This captive rearing and release strategy provides the opportunity for natural and sexual selection (see van Den Berge and Gross 1989; Fleming and Gross 1994) to occur on the spawning grounds, and thereby reduces the potential for genetic change associated with artificial spawning of the adults and hatchery propagation of the progeny. Previous studies have suggested that captively reared adults do not have the same level of breeding success as wild adults (Berejikian et al. 1997). Thus, there is a need to improve culture technology in attempts to achieve the maximum reproductive performance possible from captively reared salmon. The breeding behavior and success studies will generate important information which can be used in developing recovery guidelines for ESA-listed chinook populations. Research on the efficacy of this strategy relative to more conventional smolt-release strategies is critical in developing sound recovery guidelines. The project outlined below provides a rare opportunity to evaluate comparative success of two rearing regimes, and thereby more fully evaluate the efficacy of adult rearing and release strategy.

This research project is designed to minimize adverse impacts and maximize benefits from the research information by doing the following: 1) The offspring of naturally spawning captive broodstock will be returned to the Dungeness Hatchery for rearing and release, 2) natural spawning and incubation will lessen the opportunity for genetic impacts of captive culture on the population, 3) strict disease prevention measures have and will continue to be taken throughout the study, and 4) research results will lead to improvement of captive broodstock technologies, thereby benefitting this and other captive populations listed under ESA.

12.2) Cooperating and funding agencies.

The research is being conducted by the National Marine Fisheries Service, Resource Enhancement and Utilization Technologies Division, located at the Manchester Research Station (MRS). Cooperating agencies include the Washington Department of Fish and Wildlife and the Jamestown S'Klallam Tribe. Funding for the research is provided by the Bonneville Power Administration.

12.3) Principal investigator:

Dr. Barry A. Berejikian, NMFS. Associate Investigators include: E. Paul Tezak, Dr. William Fairgrieve, Thomas Flagg, and Anita LaRae.

12.4) Status of stock (In addition to the information provided below, refer to section 2.2.1 2.2.2 and 2.2.3)

The Dungeness spring chinook salmon captive broodstock population is currently listed as

"threatened" under ESA. The majority of fish in this population are cultured at the WDFW Hurd Creek Hatchery. WDFW's program involves egg collections from natural spawners, full-term captive culture, artificial spawning of captive brood adults, incubation of the embryos, and rearing and release of subyearling smolts.

On 20 April 1998 (prior to listing) 231 Dungeness spring chinook captive broodstock (brood year 1996) were transported to the Manchester Research Station for rearing in seawater. At that time, the fish were made available for research and evaluation of captive broodstock technologies by NMFS scientists. The fish have been cultured on filtered, UV sterilized seawater from the time of transport to the present. Currently 128 adults remain in the population. The fish are currently held in 4 separate rearing tanks (4-m in diameter). Each tank receives 110 L/minute of filtered, UV-sterilized seawater (this same water supply is used to culture 6 other chinook salmon populations listed as "endangered" under ESA, which are annually returned from the Manchester facility to their natal or ancestral streams in Oregon and Idaho).

The water velocity in two of the tanks has been increased by 2.0-horsepower pumps with variable speed controllers to maintain maximum current velocities of 1 fish body length/second (adjusted monthly). Velocities in the other two tanks are not increased. In early July, the maturing fish will be transported to two freshwater holding tanks at the Manchester Research Station. The majority of fish are expected to mature in August/September 2000.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied. (See 2.2.3)

In late August 2000, maturing adults will be anesthetized, weighed, and measured. A Peterson Disk tag will be attached to each fish for individual identification. Reproductive behavior experiments will be conducted in a quasi-natural stream channel at the Manchester Research Station. The sidewalls and floor of the channel (45 m long by 6 m wide overall) are constructed of concrete at a constant 3% gradient. The water depth (25 - 35 cm), velocity (up to 0.5 m/s), gravel size (3 - 8 cm), gravel depth, and temperature (approximately 10 ˚C) are within the documented range of natural spawning habitat for the species (Burner 1951, Briggs 1953). The channel uses well-water (80 L/minute) which is re-circulated at a flow rate of approximately 6,250 L/minute.

Upon maturity, the chinook salmon will be placed into the spawning channel for natural spawning. The reproductive behavior of all fish placed in the channel will be monitored following pre-established protocols (Berejikian et al. in press). In 1997, Dungeness River captively reared chinook salmon spawned successfully in the same channel, and exhibited high egg-to-fry survival (~ 65% green-egg-to-emergence). The naturally spawned embryos will be left in the gravel undisturbed, and water temperatures will be manipulated to mimic temperatures in the Dungeness River. This will ensure natural fry emergence timing.

12.6) Dates or time period in which research activity occurs

Reproductive behavior experiments will begin in late August and terminate in late September, 2000. Embryos will incubate in the gravel from late August through late February. Emergent fry were collected in early March, 2001 and will be returned to the Dungeness River following tagging by state and tribal personnel.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

For adult culture and spawning methods, see 12.4 and 12.5. Once spawning has been completed. The embryos will be allowed to incubate in the gravel and emerge naturally. After emergence, fry will be periodically seined out of the channel and placed into holding tanks supplied with well water, and fed. The fry will be transported and released into the Dungeness River. The otolith strontium/calcium ratios reflecting a maternal seawater rearing environment will distinguish these fish from other fish produced from the Dungeness Captive Broodstock and from wild fish. Transport time to the Dungeness River will be approximately 2.5 hours.

12.8) Expected type and effects of take and potential for injury or mortality

Fish naturally spawning in the stream channel may produce fewer fry than if the same fish were to be spawned artificially. For example, females spawning in the channel may not deposit all of their eggs, some eggs may not be fertilized, and some embryos may not survive to emergence. It is important to note, however, that egg fertilization and viability can vary widely during artificial spawning as well. The reproductive success of fish spawning in the protected stream channel environment is likely much higher than it would be in the wild. Previous experiments in this stream channel with the same population indicated that of the eggs deposited by females, and estimated 65% produced viable fry, which is much higher than would be expected in natural streams (Berejikian et al., submitted).

One of the main concerns in artificial propagation program is domestication selection and the relaxation of selective pressures on the fish (Busack and Currens, 1995). Reintroducing captively reared populations back into the natural environment as mature adults (instead of the artificially cultured progeny which may have derived from them) may reduce the potential for unnatural genetic selection (Reisenbichler 1996). Therefore, the natural and sexual selection pressures acting on spawning adults, incubating embryos and emerging fry in the spawning channel should increase the ultimate fitness of these fish (i.e., their own ability to reproduce) relative to those spawned artificially at the Dungeness Hatchery.

A small amount (<0.1% based on previous studies) of mortality may occur as the fish are seined out of the stream channel. We expect that this mortality will be no more than might occur during

conventional hatchery sampling.

Note: As of February, 2001, there were 50 non-mature adult Dungeness chinook from the 1996 brood left at the NMFS Manchester Research Station. There is not adequate space to hold these adults at the research station beyond April, 2001, as well as at the WDFW Dungeness Hatchery. These fish are 5 year old adults averaging about 15 pounds each. It is assumed that the majority of these fish are females since only 8 of the 40 fish used in the spawning channel experiment at Manchester were ripe males. Transferring 40+ females to Dungeness would exacerbate the imbalance of females to males which the project is already experiencing.

In April of 2001 the 50 adult bright chinook were hauled and released directly into the saltwater of Dungeness Bay where they have the benefit of being close to their native river. It is assumed that all of the adults will mature and those that survive should begin entering the river in August or September to spawn naturally.

12.9) Level and take of listed fish

If the 50 adults mentioned above were transferred from the NMFS Manchester Research Station (saltwater) to the WDFW Dungeness Hatchery (freshwater), 100% mortality is predicted. If the 50 are released directly into saltwater in Dungeness Bay, mortality is expected to be minimal.

12.10) Alternative methods to achieve project objectives.

The only alternative that would achieve a portion of the project objectives would be to release the adults directly into the Dungeness River and monitor their breeding behavior in the river rather than in the stream channel. This would result in a much poorer behavioral evaluation of breeding success. It would also likely decrease the reproductive success of the fish because the incubating embryos would not receive the protection from adverse environmental conditions (e.g., streambed scour or entombment of redds) that is provided in the stream channel.

12.11) List species similar or related to the threatened species: provide number and causes of mortality related to this research project

There is no expected mortality of similar or related species beyond that which may be described in other sections of this HGMP.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

In order to minimize the potential for disease transfer from this captive broodstock to chinook salmon in the Dungeness River, the following precautions have and will be taken. 1) The fish are being held on filtered UV-sterilized seawater, which has been approved for the culture of ESA-listed chinook and sockeye salmon. 2) Prior to introducing the adults, the entire stream channel and freshwater holding facility will be disinfected with chlorine. 3) The adults and their offspring will be held entirely on pathogen-free well water, and 4) Adult pathogen screening will be conducted following co-manager guidelines.

Allowing captively reared populations to spawn naturally reduces the time in which it is exposed to the hatchery environment, and thereby, reduces the potential for unintentional deleterious genetic change. Spawners in the stream channel will be able to compete intrasexually for spawning sites (females) and for mates (males). Both sexes may exhibit intersexual selection (i.e., mate choice: Foote and Larkin 1988; Foote 1989; Berejikian in press). Both types of inter- and intra-sexual selection are important in maintaining reproductive fitness of the population. Developing embryos in the gravel will also undergo natural selection during incubation and emergence. It is impossible to exactly quantify the effects of natural vs. artificial spawning. However, based on existing scientific information, it is concluded that the studies involving natural spawning have conservation benefits, which will outweigh any potential production by not artificially spawning the adults (also not 100% successful).

References

Berejikian, B. A., E. P. Tezak, and A. L. LaRae. In Press. Female mate choice and spawning behavior of chinook salmon (*Oncorhynchus tshawytscha*) under experimental conditions. J. Fish. Biol.

Berejikian, B. A., Tezak, E. P., Schroder, S. L., Knudsen, C. M. & Hard, J. J. (1997). Reproductive behavioral interactions between spawning wild and captively reared coho salmon (*Oncorhynchus kisutch*). *ICES Journal of Marine Science* **54**, 1040-1050.

Berejikian, B. A., E. P. Tezak**,** and S. L. Schroder. *Submitted* 2/10/2000. Reproductive behavior and breeding success of captively reared chinook salmon (*Oncorhynchus tshawytscha*). N. Am. J. Fish. Manage.

Briggs, J. C. (1953). The behavior and reproduction of salmonid fishes in a small coastal stream. *California Department of Fish and Game Bulletin* **94**, 62 p.

Burner, C. J. (1951). Characteristics of spawning nests of Columbia River salmon. *Fisheries Bulletin of the Fish and Wildlife Service* **61**, 97-110.

Busack, C. A., and K. P. Currens. (1995). Genetic risks and hazards in hatchery operations: fundamental concepts and issues. American Fisheries Society Symposium **15**, 71-80.

Fleming, I. A. & Gross, M. R. (1994). Breeding competition in a Pacific salmon (coho: *Oncorhynchus kisutch*): measures of natural and sexual selection. *Evolution* **48,** 637-657.

Foote, C. J. (1989). Female mate preference in Pacific salmon. *Animal Behavior* **38,** 721-723.

Foote, C. J. & Larkin, P. A. (1988). The role of male choice in the assortative mating of anadromous and non-anadromous sockeye salmon (*Oncorhynchus nerka*). *Animal Behaviour* **106,** 43-62.

Reisenbichler, R. R. (1996). Genetic Factors contributing to declines of anadromous salmonids in the Pacific Northwest. In: *Pacific Salmon and their ecosystems*. (Ed. by D. Stouder and R. Naiman), pp. 223-244. Chapman Hall, Inc.

Van den Berghe, E. P. & Gross, M. R. (1989). Natural selection resulting from female breeding competition in a Pacific salmon (Coho: *Oncorhynchus kisutch*). *Evolution* **43**, 125-140.

SECTION 13. ATTACHMENTS AND CITATIONS

Dungeness River Chinook Salmon Rebuilding Project; Progress Report 1992-93; WDFW, Jamestown S"Klallam Tribe, USFWS Project Report Series #3, (1995)

Herring, D. 1999. Salmon and Steelhead Limiting Factors. Water Resource Area 18. Washington State Conservation Commission. Olympia, Wa.

Hershberger, W.K., and R.N. Iwamoto. 1981. Genetics Manual and Guidelines for the Pacific Salmon Hatcheries of Washington. Univ. of Wash. College of Fisheries. Seattle, Wa. 83 pp.

McElhany, P., M.H. Ruckelhaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-NWFSC-42. 156 pp.

Piper, Robert et. al. 1982. Fish Hatchery Management; United States Dept of Interior, Fish and Wildlife Service, Washington, DC.

Seidel, Paul. 1983. Spawning Guidelines for Washington Department of Fish and Wildlife Hatcheries. Washington Department of Fish and Wildlife. Olympia, Wa.

U.S. District court of Western Washington. 1976. United States v. Washington, 384 F, Supp. 312.

United States v. Washington, No. 9213 Phase 1 (sub no. 85-2) Order Adopting Puget Sound Management Plan, 1985

Washington Department of Fisheries. 1991. Stock Transfer Guidelines. Hatcheries Program,Washington Department of Fisheries. Olympia, Wa.

Washington Department of Fisheries, Washington Department of Wildlife and Western Washington Treat Indian Tribes. 1992. Washington State Salmon and Steelhead Stock Inventory. Olympia, Wa. pp122-130.

Washington Department of Fish and Wildlife. 1996. Fish Health Manual. Hatcheries Program, Fish Health Division, Washington Department of Fish and Wildlife. Olympia, Wa.

Washington Department of Fish and Wildlife and Western Washington Treaty Indian Tribes. 1998. Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Olympia, Wa.

Washington Department of Fish and Wildlife and Puget Sound Treaty Tribes, 2002, "Puget Sound Chinook Salmon Hatcheries, Resource Management Plan", a component of Comprehensive Chinook Salmon Management Plan, August 23, 2002. 103 pages.

WDFW and PNPTC. 2000. Summer Chum Salmon Conservation Initiative: An Implementation Plan to Recover Summer Chum Salmon in the Hood Canal and the Strait of Juan de Fuca. Editors: Jim Ames, Gary Graves and Chris Welder. 423 pp + app.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

Table 1. Estimated listed salmonid take levels by hatchery activity.

Listed species affected: Chinook ESU/Population: Puget Sound Activity: Hatchery Operations				
Location of hatchery activity: Dungeness River and Hurd Creek Dates of activity: ongoing Hatchery program operator: WDFW				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			2,000*	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)			up to 112	
Intentional lethal take f)			up to 112	
Unintentional lethal take g)				
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

* Potential take associated with the Pink Salmon recovery weir at river mile .4. See section 2.2.3